

WHAT IS CLAIMED IS:

1. A process for separating the components of a multi-component gas stream, the process comprising:

contacting the multi-component gas stream with a solvent in an extractor to produce an overhead stream that is enriched in at least one unabsorbed component gas and a rich solvent bottoms stream that is enriched in at least one absorbed component gas;

flashing the rich solvent bottoms stream in at least one reduced pressure stage to regenerate lean solvent and to produce an overhead stream that is enriched in the at least one absorbed component gas;

recycling the regenerated lean solvent to the extractor;

compressing the overhead stream that is enriched in the at least one absorbed component gas to produce a product stream; and

recycling a portion of the product stream to the extractor.

2. The process of claim 1, wherein the multi-component gas stream comprises at least one hydrocarbon.

3. The process of claim 1, wherein the multi-component gas stream comprises one or more components selected from the group consisting of hydrogen, nitrogen, helium, argon, methane, ethylene, ethane, heavier saturated and unsaturated hydrocarbons and mixtures thereof.

4. The process of claim 1, wherein the unabsorbed component gas comprises nitrogen.

5. The process of claim 1, wherein the unabsorbed component gas comprises hydrogen.

6. The process of claim 1, wherein the product stream comprises methane.

7. The process of claim 1, wherein the solvent is one of the components of the multi-

component gas stream.

8. The process of claim 1, wherein the solvent is an external solvent that is added to the process.

9. The process of claim 1, wherein the solvent is selected from the group consisting of paraffinic solvents, naphthenic solvents, and aromatic solvents.

10. The process of claim 1, wherein the extractor is a tower with internals to promote mass transfer.

11. The process of claim 1, wherein the multi-component gas stream is counter-currently contacted with the solvent.

12. The process of claim 1, wherein the recycled portion of the product stream is introduced to the extractor at a point in the extractor below where the multi-component gas stream enters the extractor.

13. The process of claim 1, further comprising providing a portion of the overhead stream that is enriched in at least one unabsorbed component gas to the at least one reduced pressure stage as a stripping gas.

14. An apparatus for separating the components of a multi-component gas stream; the apparatus comprising:

an extractor for contacting the multi-component gas stream with a solvent to produce an overhead stream that is enriched in at least one unabsorbed component gas and a rich solvent bottoms stream that is enriched in at least absorbed component gas;

at least one reduced pressure stage for flashing the rich solvent bottoms stream to regenerate lean solvent and to produce an overhead stream that is enriched in the at least one absorbed component gas;

piping suitable to recycle the regenerated lean solvent back to the extractor;

a compressor for compressing the overhead stream that is enriched in at least one absorbed component gas to produce a product stream; and
piping suitable for recycling a portion of the product stream back to the extractor.

15. The apparatus of claim 14, wherein the extractor is a tower with internals to promote mass transfer.

16. The apparatus of claim 14, wherein the multi-component gas stream is counter-currently contacted with the solvent.

17. The apparatus of claim 14, wherein the piping suitable for recycling a portion of the product stream back to the extractor enters the extractor a point below where the multi-component gas stream enters the extractor.

18. The apparatus of claim 14, further comprising piping suitable for providing a portion of the overhead stream that is enriched in at least one unabsorbed component gas to the at least one reduced pressure stage as a stripping gas.